**HIGH-TEMPERATURE SCANNING INDENTATION: A NEW TECHNIQUE TO ASSESS MICROSTRUCTURAL CHANGES ALONG THERMAL RAMPING**

Jean-Luc LOUBET, LTDS, UMR CNRS 5513, ECL, France
jean-luc.loubet@ec-lyon.fr
Gabrielle TIPHENE, LTDS, UMR CNRS 5513, ECL, France ; EMSE, UMR CNRS 5307 LGF, France
Paul BARAL, EMSE, UMR CNRS 5307 LGF, Centre SMS, Saint-Etienne, France
Solène COMBY-DASSONNEVILLE, Aix Marseille Univ, Université de Toulon, CNRS, IM2NP, Marseille, France
Gaylord GUILLONNEAU, LTDS, UMR CNRS 5513, ECL, France
Guillaume KERMOUCHE, EMSE, UMR CNRS 5307 LGF, Centre SMS, Saint-Etienne, France
Jean-Michel BERGHEAU, LTDS, UMR CNRS 5513, ECL, France
Warren OLIVER, KLA Nanomechanics Inc, Oak Ridge, USA

Key Words: high temperature nanoindentation, anisothermal measurements, cold-rolled pure aluminum, microstructure changes, creep properties

Thanks to recent developments in high temperature nanoindentation testing, investigation of thermally activated mechanisms at small length scales can now be carried out [1]. *In-situ* anisothermal measurements at the micron-scale of hardness, Young modulus and creep properties are now feasible. The development of the High Temperature Scanning Indentation [2] technique, based on a specific high-speed loading procedure, allows quasi-continuous determination of those properties in temperature in only few hours.

We focus here on cold-rolled pure aluminum (see figure) that undergoes static recovery and recrystallization during an annealing thermal cycle: Hardness upon heating and cooling varies in a different manner, pointing out the occurrence of those phenomena upon heating. Part of the observed hardness drop was related to recrystallization, assessed by post-mortem EBSD microstructural characterizations. Moreover, such methodology allows to determine creep properties. Such information leads to the determination of creep activation energy of those samples.

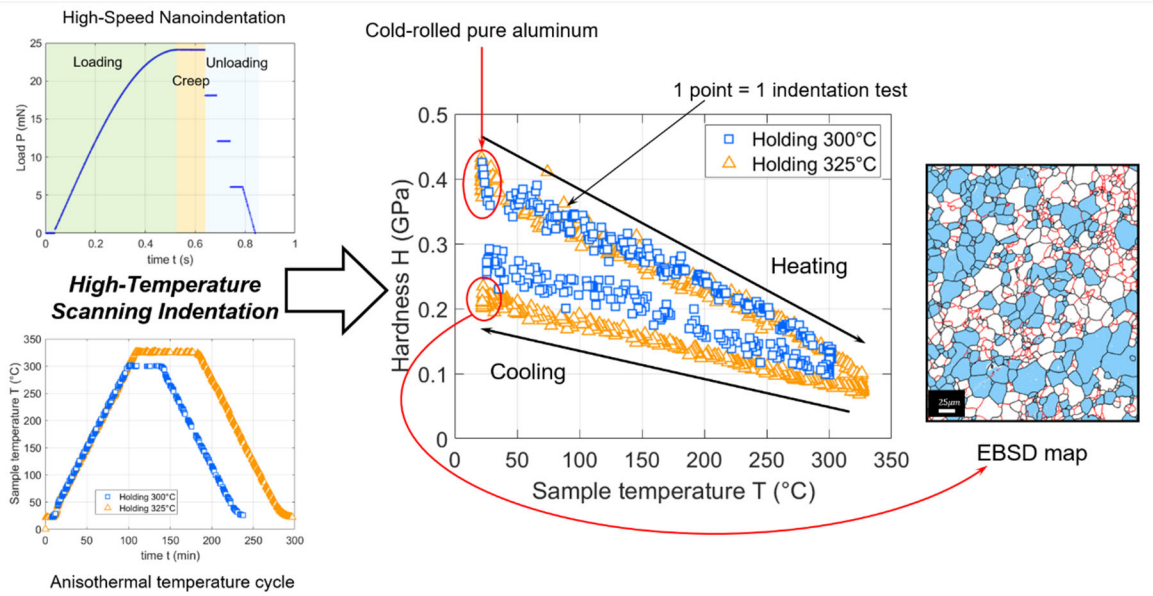


*Figure 1 - HTSI method used on cold-rolled pure aluminum samples. Hardness evolution during the thermal cycle shows the microstructure changes, from [2].*

[1] Baral et al., Materials and Design, (2018)
[2] Tiphéne et al., Journal of Material Research, (2021)